A PRELIMINARY STUDY ON CYCLIC BEHAVIOUR OF SFS DOWELLED CONNECTIONS IN GLULAM FRAMES

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1 Introduction

SFS self-drilling dowels are a proprietary product from Rothoblaas. They can go through timber and up to 10 mm steel plates without pre-drilling. The advantages are:

- High strength
- High stiffness
- High-efficient on-site assembly

This research proposed an idea of using SFS dowels and inserted steel plates to build up timber joints for braced timber buildings. However, some questions need to be figured out:

- Strength and stiffness under cyclic loading
- Ductility
- Hysteretic characteristics
- Overstrength value

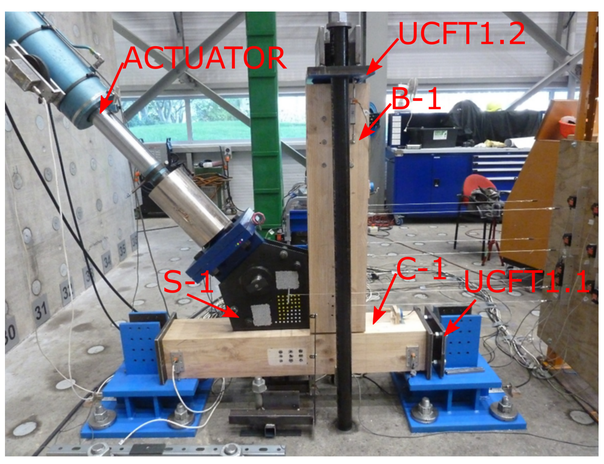
Self-drilling dowels (SFS) (Rothoblaas)

Beatrice Tinsley Building at the University of Canterbury

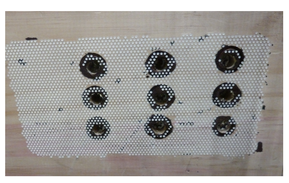
2 Experimental Programme

The SFS dowelled connections were designed to connect the braces to the beam and column. Some key points are listed:

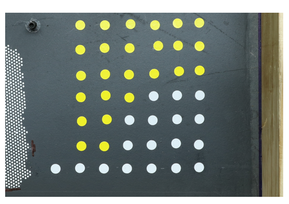
- GL10 grade glulam was used for the beams and columns
- 6 mm Grade 300 steel plates were used as inserted gusset plates
- Φ7 x173 SFS dowels were used to connect the gusset plates and timber members
- Each connection group contained 9 SFS dowels
- The loading protocol followed EN12512
- Three replicates were tested
- Particle tracking velocimetry (PTV) was used with potentiometers



Connection test setup



1) dots on timber



2) dots on steel plates

PTV dots

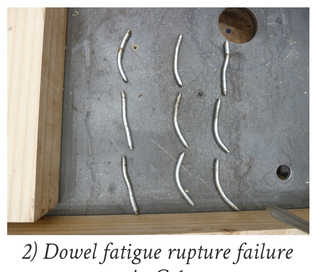
3 Experimental Results

The tests were stopped when the strength decreased to 80% of the maximum load and one of the connections was cut open.

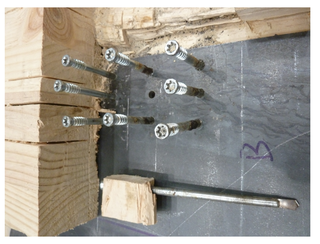
The main observations were listed as below:

- Timber embedment crushing in C-1
- Significant bending yielding deformation of the SFS dowels in C-1
- Low-cycle fatigue failure of the dowels in C-1
- SFS dowels in B-1 kept almost elastic

1) Timber embedment failure in C-1



2) Dowel fatigue rupture failure in C-1



3) SFS dowels in B-1

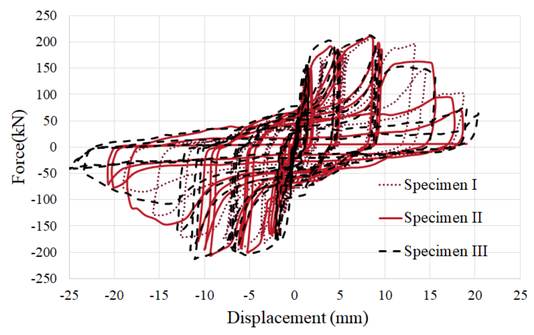
Cut-open of specimens

The force-displacement relationships have been recorded for C-1 and B-1. Besides that, the energy dissipation curves were drawn for three specimens.

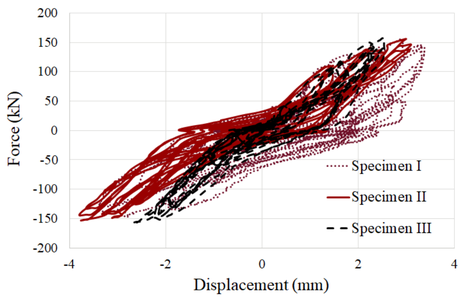
The main results were listed as below:

- The average yield strength and maximum strength for a group of connections were 153.3 kN and 208.8 kN, respectively
- Average ductility is 10.8
- Small hysteretic energy dissipation during the first eleven loading cycles; significant energy dissipation increase followed by them

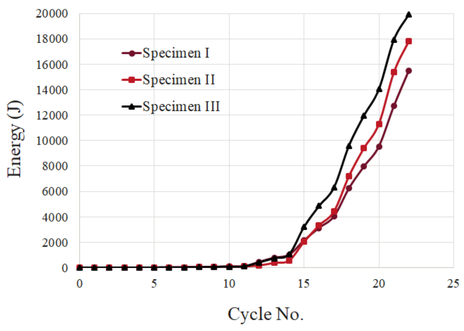
The displacement of the connections were recorded by PTV and verified by potentiometers. The PTV results captured the deformation well.



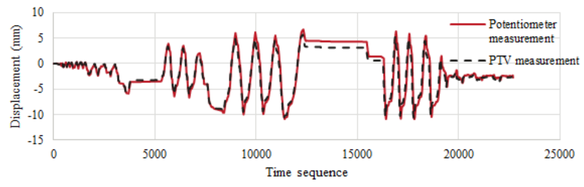
Force-displacement curve in C-1 connection



Force-displacement curve in B-1 connection



Energy dissipation in C-1 connection



Validation of PTV results

4 Conclusions

This study presents a preliminary experimental study on cyclic performance of SFS dowelled connections. The following conclusions can be drawn:

- The SFS dowel connections performed well with high strength, initial stiffness, ductility and good energy dissipation capacity
- The PTV measurement matches the potentiometer measurement well

5 Acknowledgements

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